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Biewald et al.

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[54] **CABLE TENSIONING DEVICE FOR ELEVATORS**

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[21] Appl. No.: **242,092**

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Related U.S. Application Data

[62] Division of Ser. No. 14,310, Feb. 5, 1993, Pat. No. 5,398,781.

[30] **Foreign Application Priority Data**

Feb. 5, 1992 [DE] Germany ..... 9201374 U

[51] **Int. Cl.**[6] **B66B 11/04**

[52] **U.S. Cl.** **187/264;** 187/266

[58] **Field of Search** 187/20, 22, 23, 26, 187/264, 266; 254/900, 335

[56] **References Cited**

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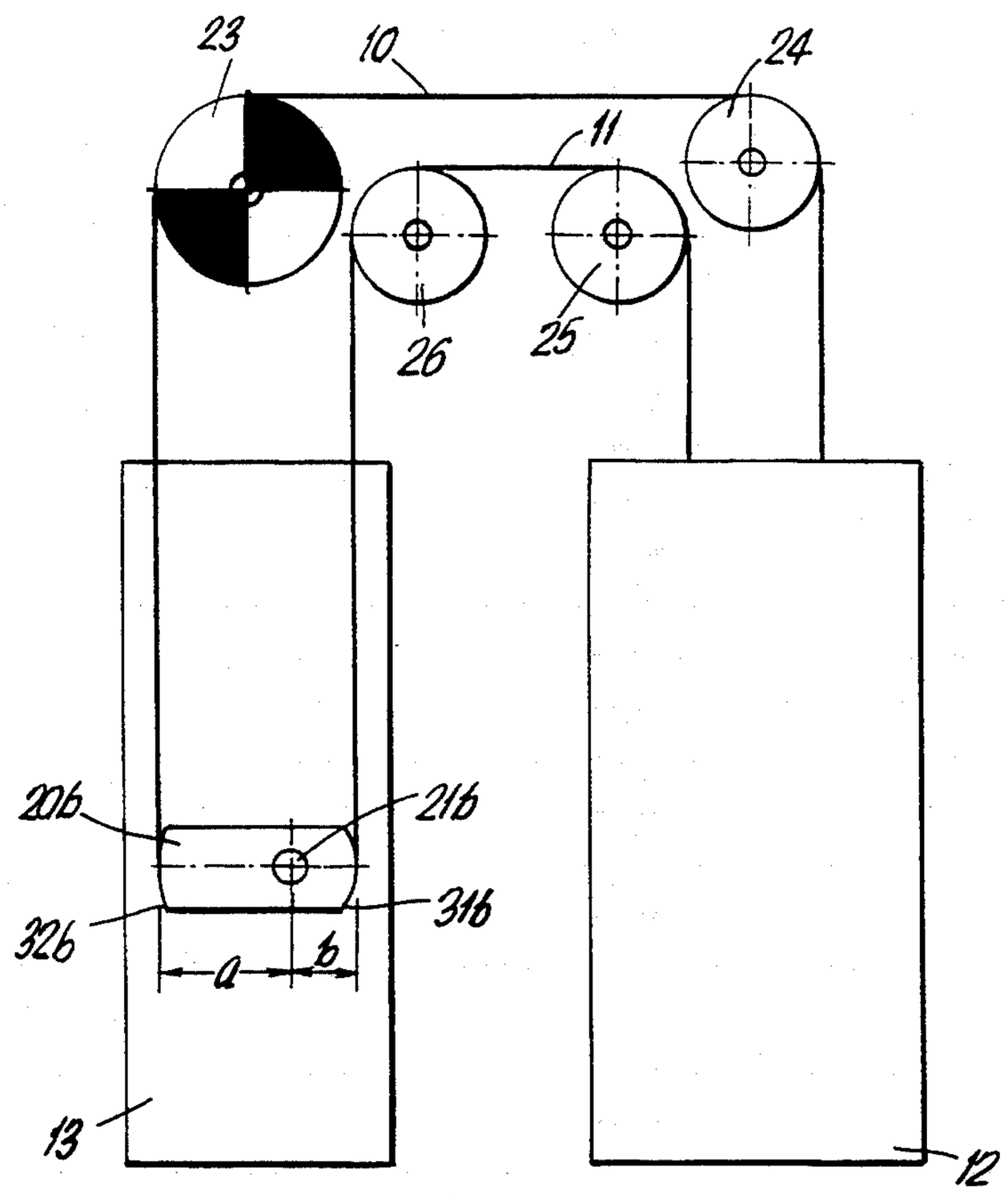
Attorney, Agent, or Firm—Anderson Kill Olick & Oshinsky

[57] **ABSTRACT**

The invention deals with a cable tensioning system for elevators with separate drive cable and support cable lines **10, 11,** which both engage at an elevator cabin **12** and also at a counterweight **13,** characterized in that the cable tensioning system comprises a rocker **20** configured as a lever and supported at the counterweight **13** or the elevator cad **12,** at which rocker the support cable **11** and the drive cable **10** are fastened to be spaced from each other, that the spacing ratio a: b of the attachment points **31, 32** of the cable lines **10, 12** at the rocker **20** from the support point **21** of the rocker **20** at the counterweight **13** or the elevator cab **12** define the cable tension or pull ratio required for the driving capacity.

4 Claims, 10 Drawing Sheets



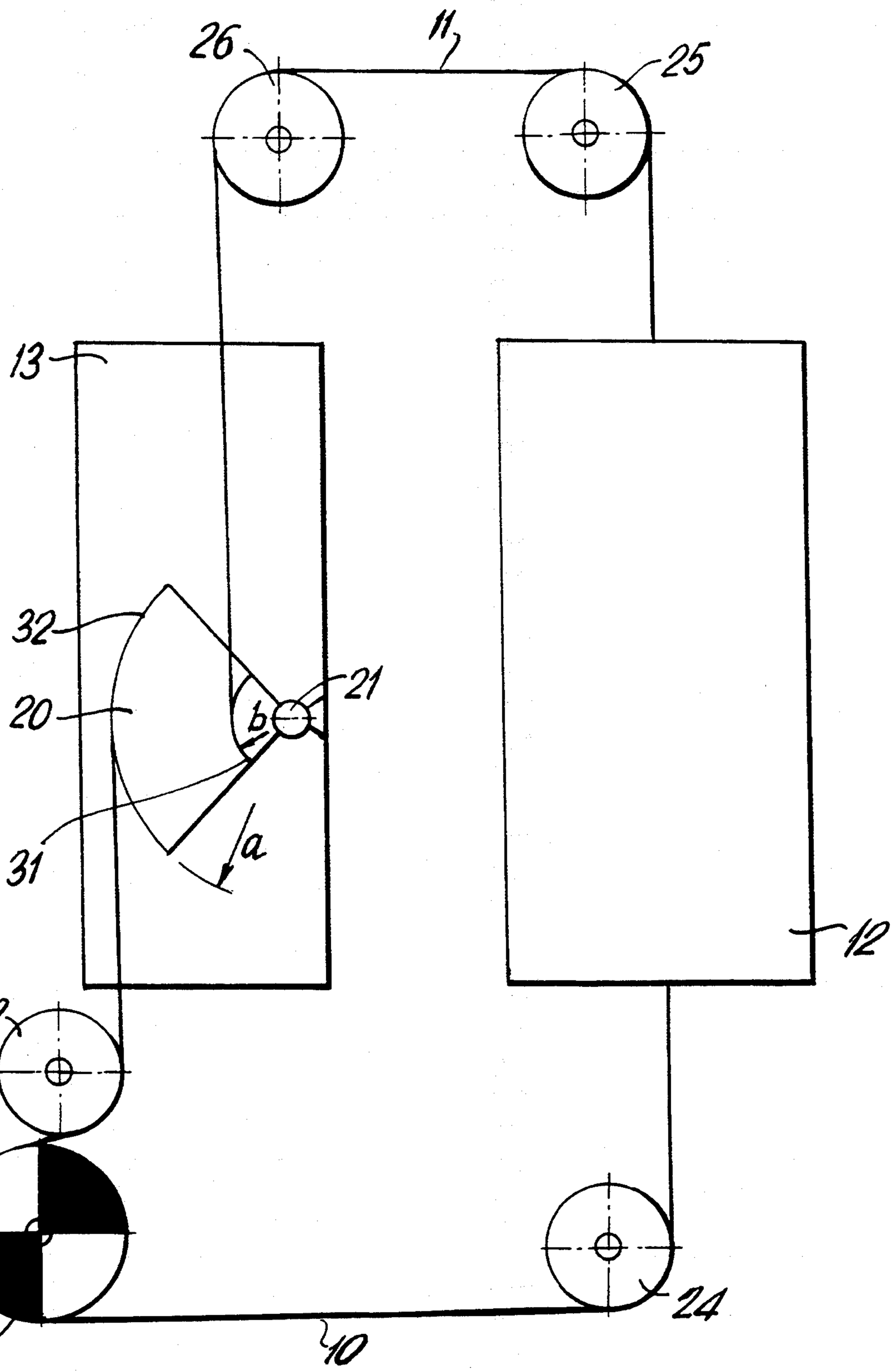


FIG. 1

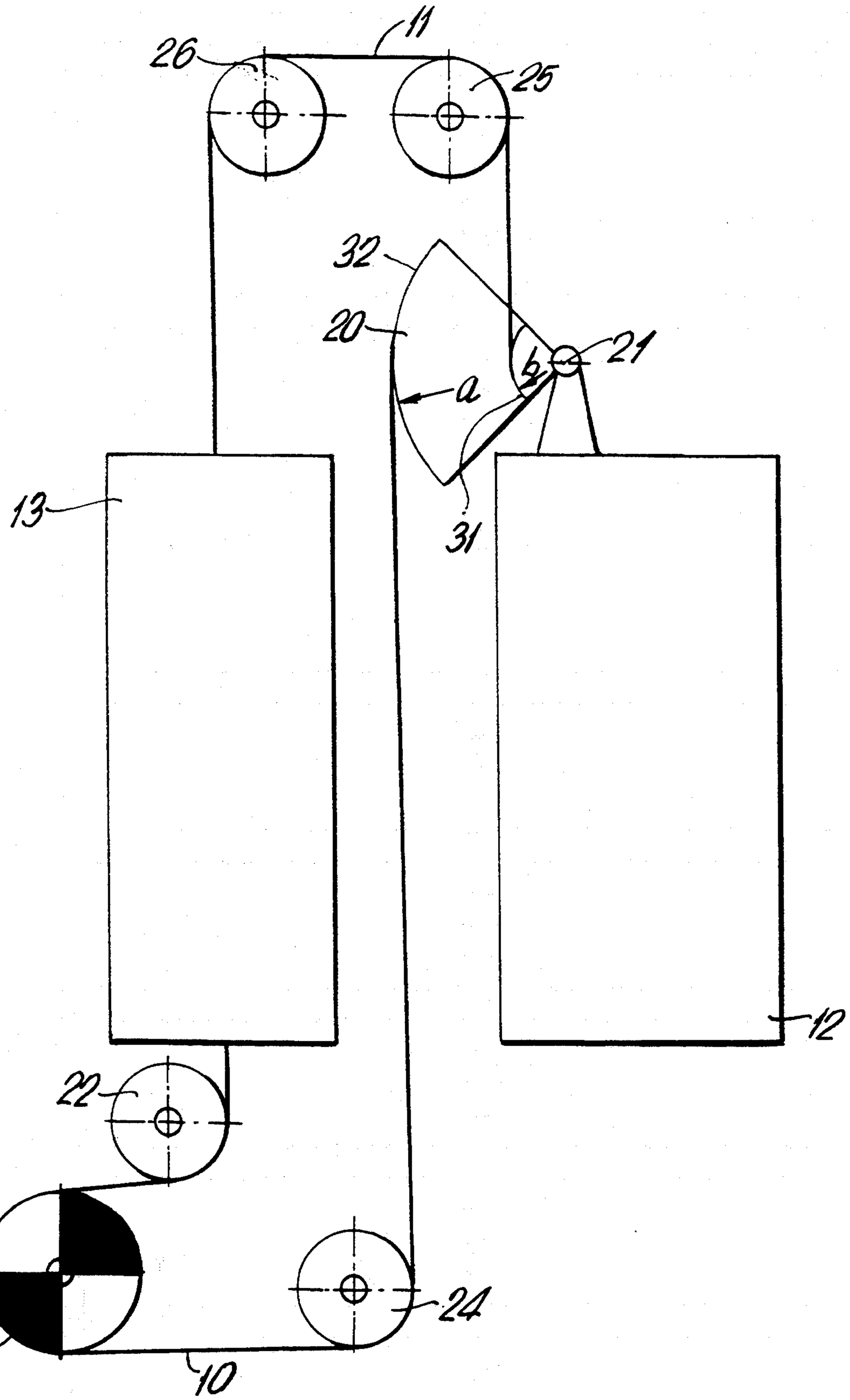


FIG.1a

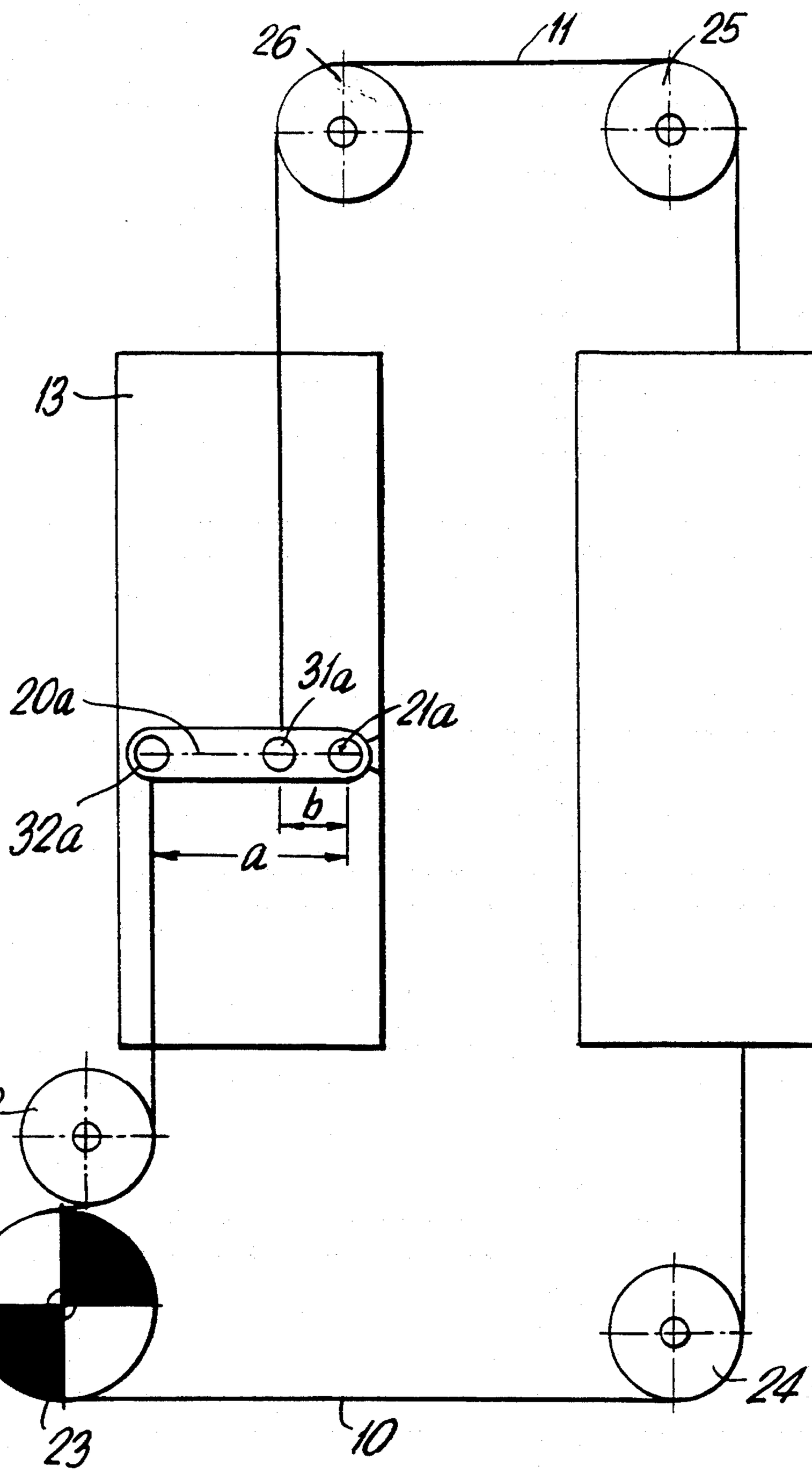


FIG. 2

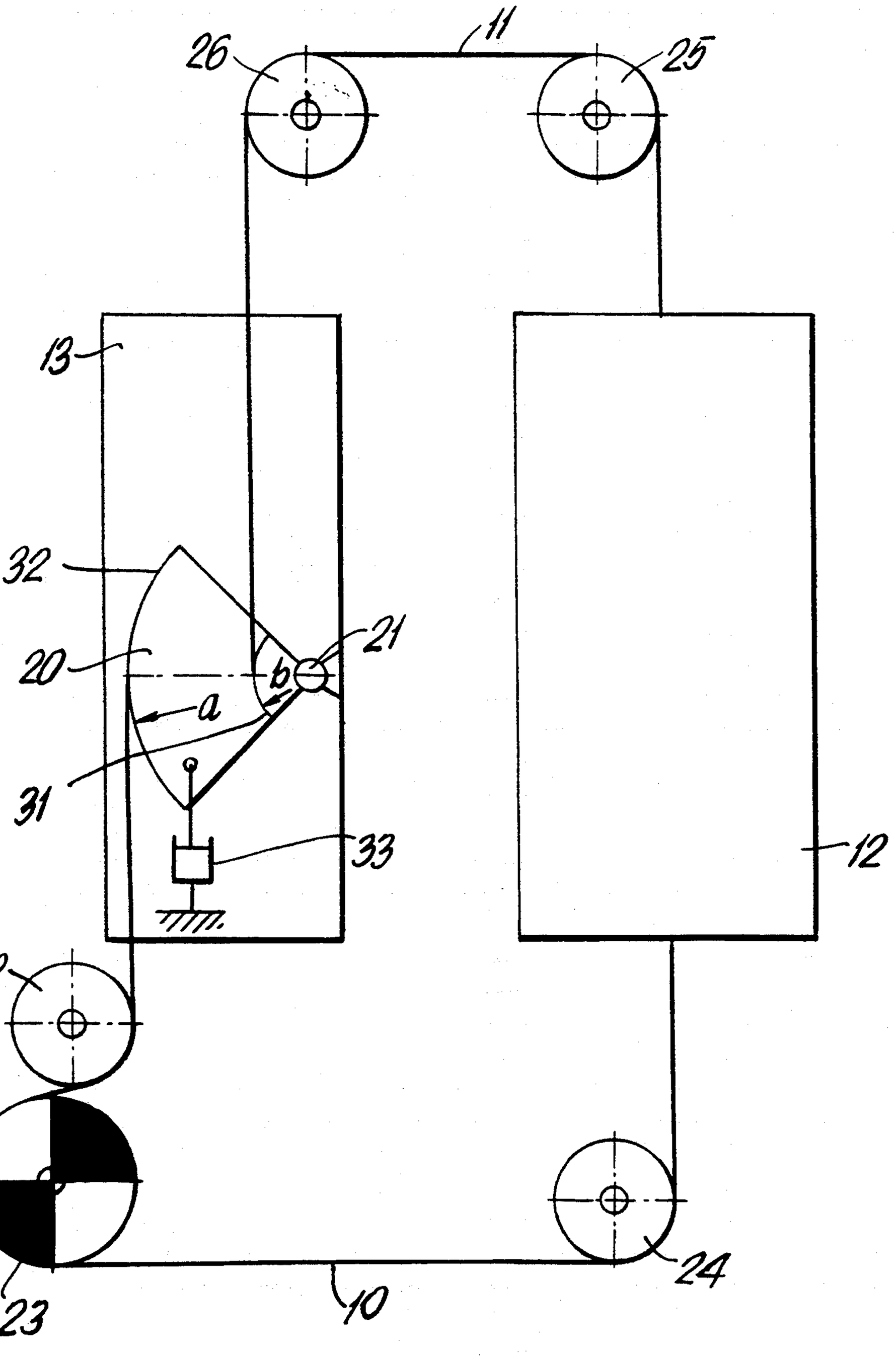


FIG. 2a

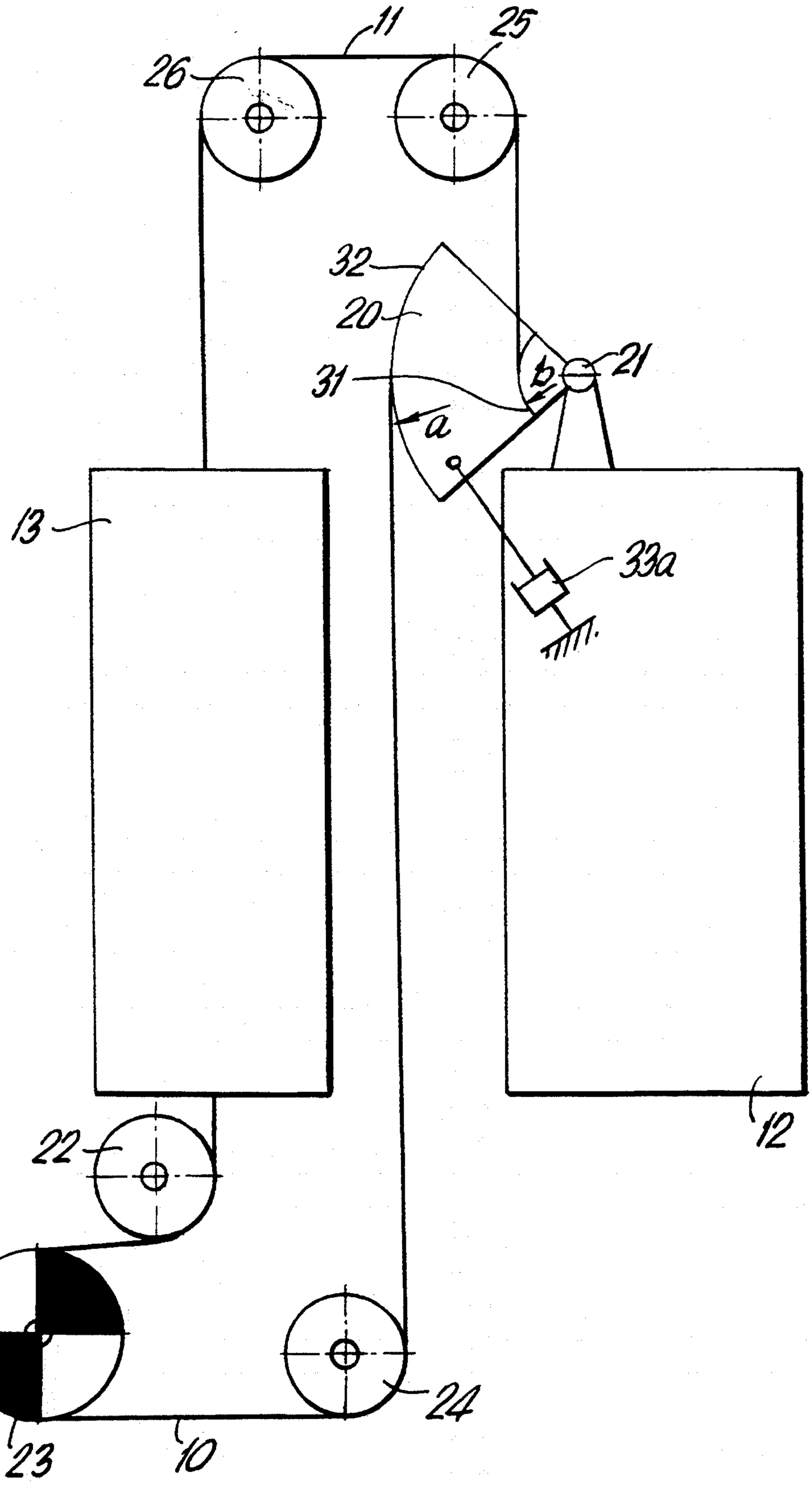


FIG. 2b

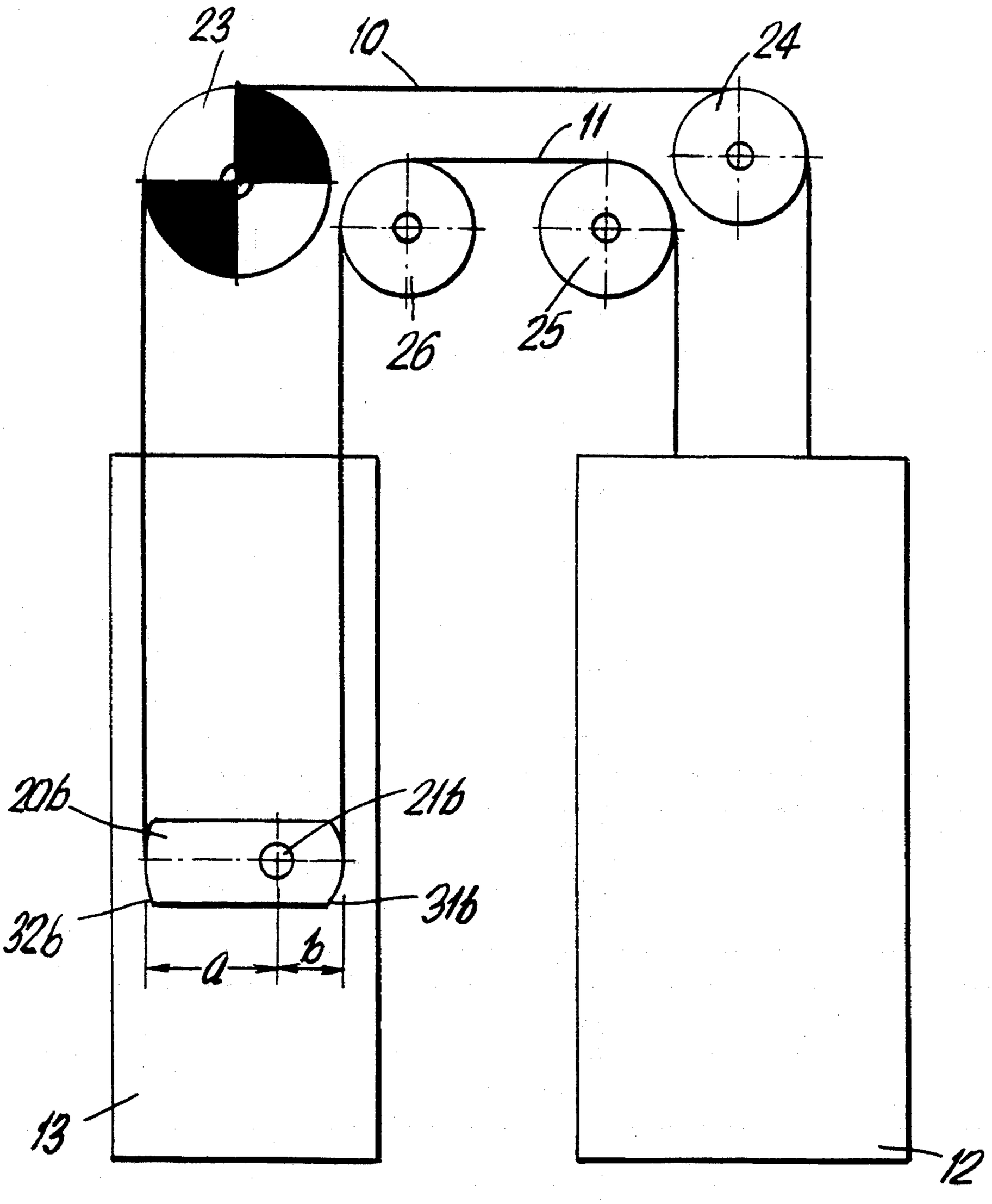


FIG. 3

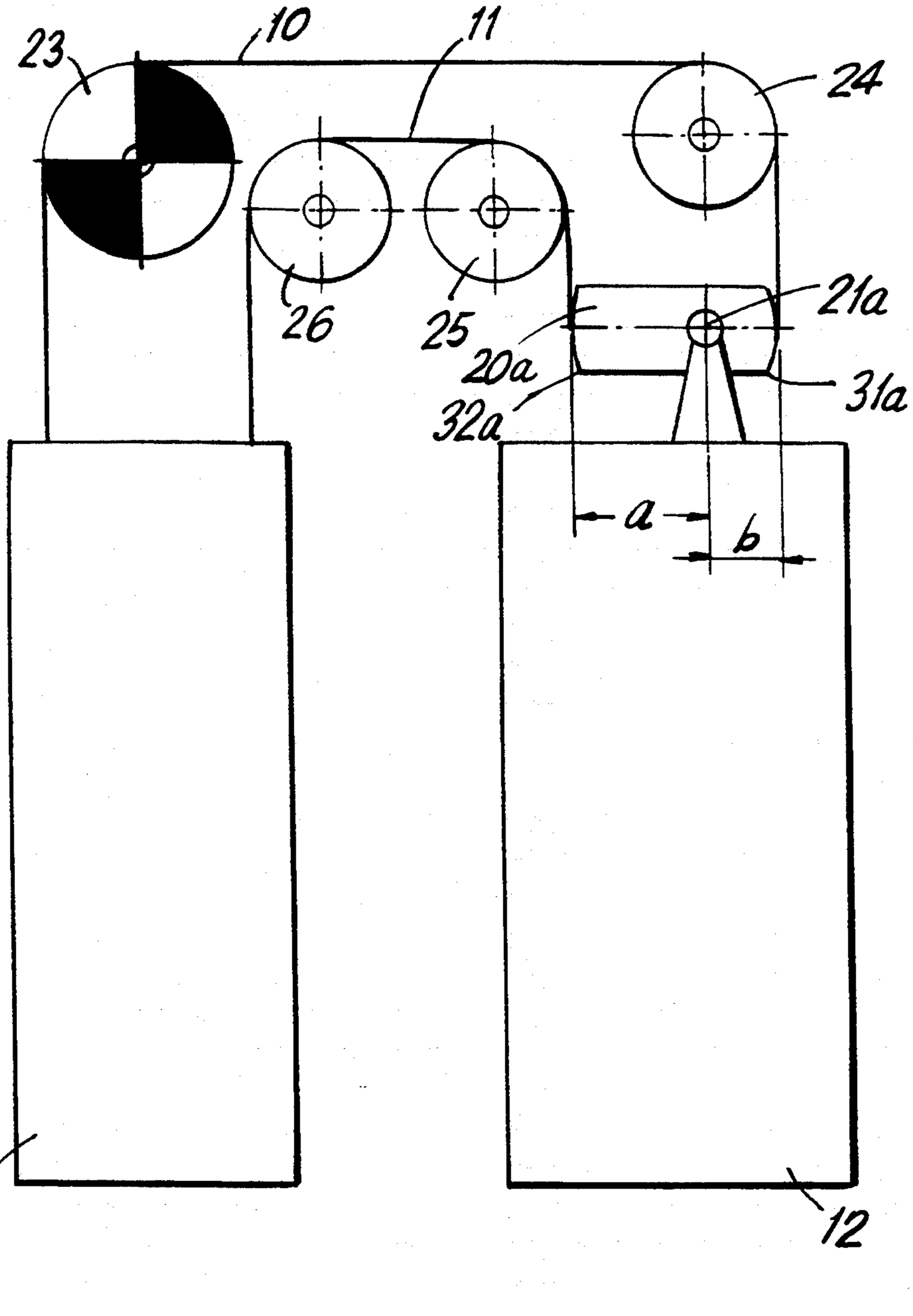


FIG. 3a

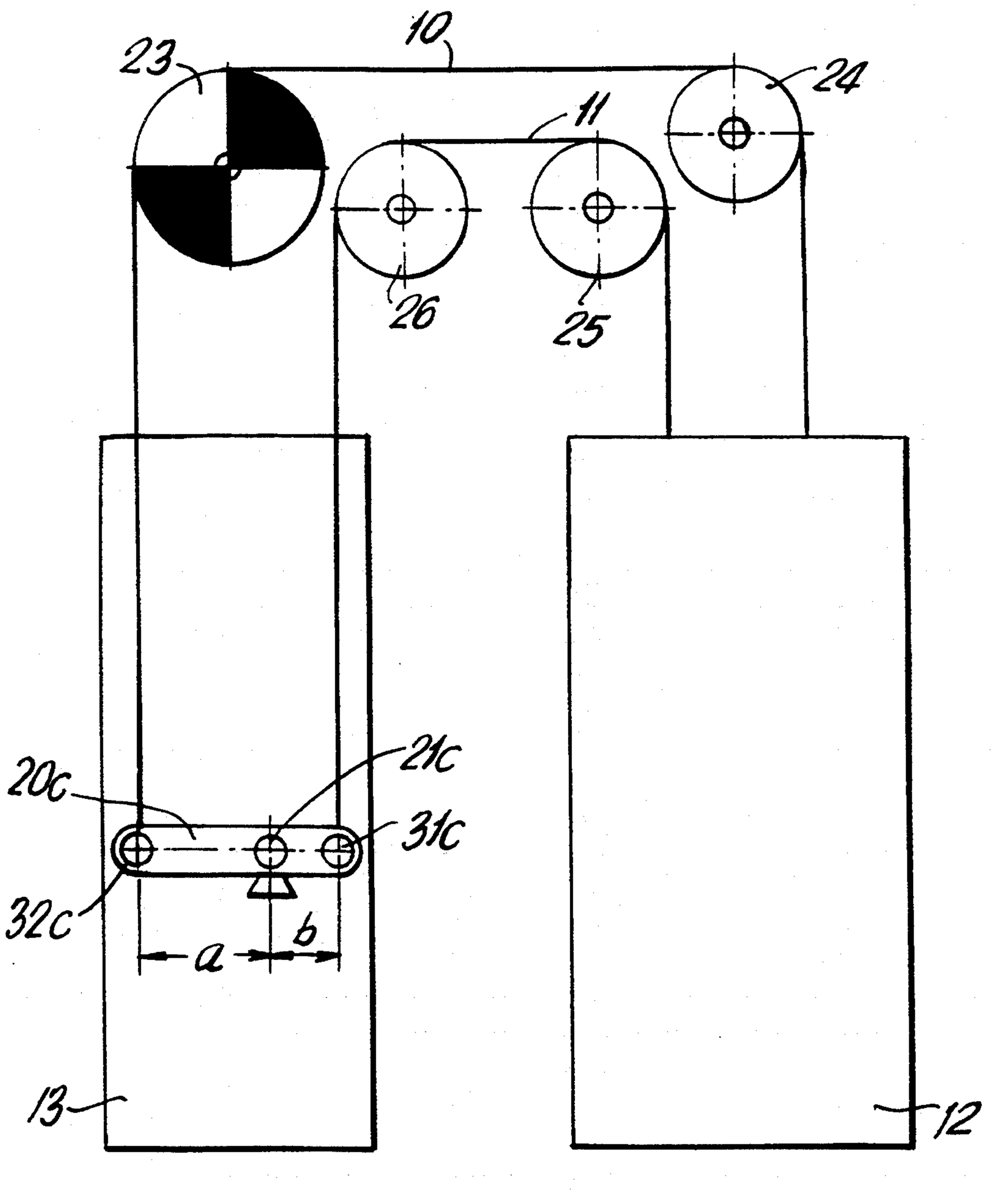


FIG.4

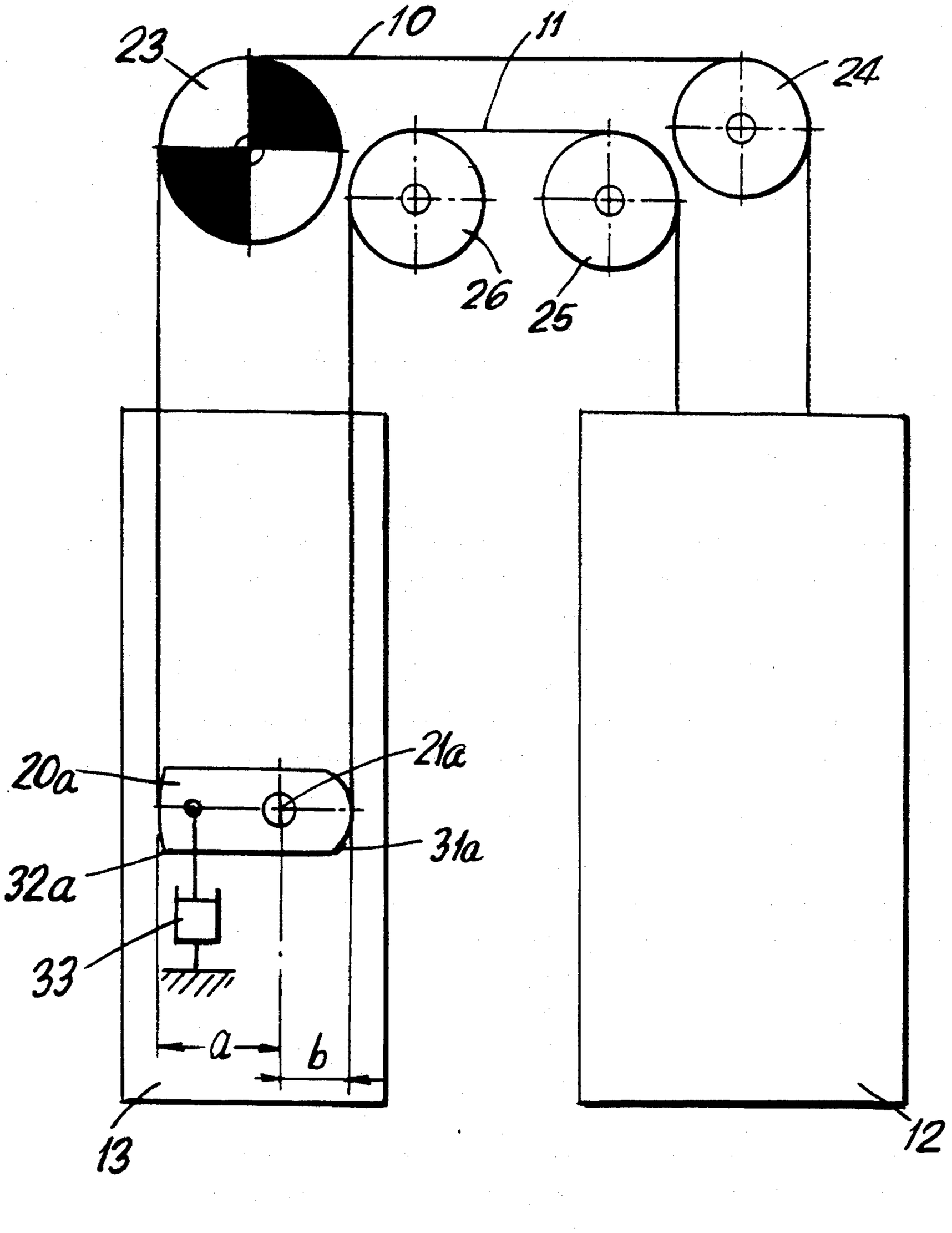


FIG.4a

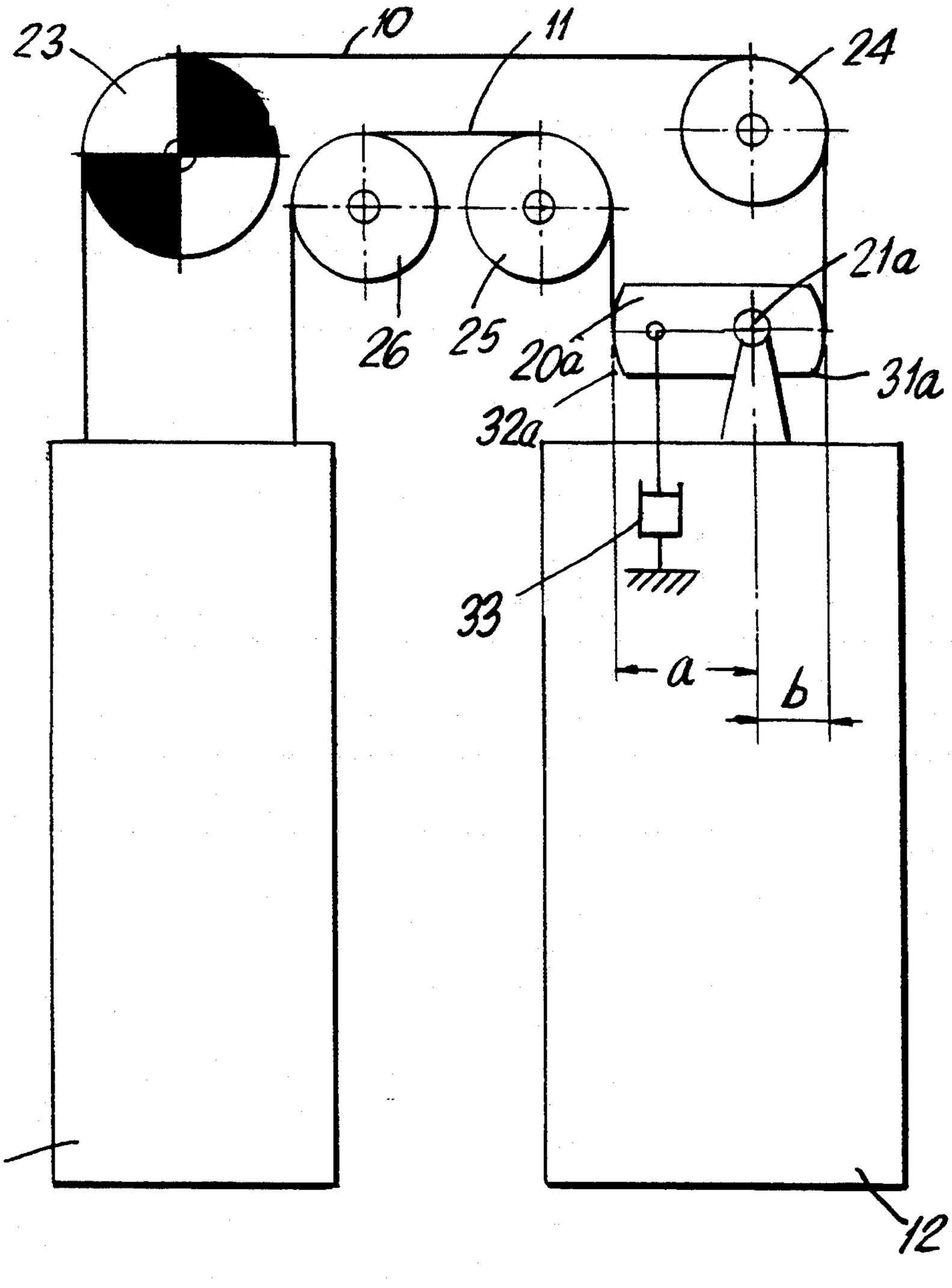


FIG. 4b

CABLE TENSIONING DEVICE FOR ELEVATORS

This is a divisional application of Ser. No. 08/014,310, filed Feb. 5, 1993 now U.S. Pat. No. 5,398,781.

BACKGROUND OF THE INVENTION

1. Field of the Invention

The invention deals with a cable tensioning device for elevators with drive cable and support cable lines separated according to the driving or support functions which both engage at an elevator cabin as well as at a counterweight.

2. Description of the Prior Art

In conventional elevator installations, where the support cable line and the drive cable line or motive cable line are separate, the drive cable is driven by a drive disk provided between the elevator cabin and the counterweight and is reversed or redirected by one or more reversing rollers. Meanwhile the support cable merely fulfills the carrying or support function and is not powered or driven. In the operation of elevator installations, especially those installed in high-rise buildings, in which the cable lengths of the power cable can amount to several hundred meters, considerable cable elongations or extensions occur in the drive cable. This can have a disadvantageous effect upon the force conditions existing between the drive disk and drive cable, the so-called cable tension or pull ratio.

SUMMARY OF THE INVENTION

In order to maintain a specific or defined cable line ratio or relationship in spite of the occurring cable elongation, a cable tensioning system has to be provided, which acts either upon the drive cable directly or upon a roller reversing same and tensions the drive cable as a function of the cable elongations.

Therefore, it is the task of the invention to provide a cable tensioning system for elevators in such a way that it can compensate for cable elongation in a closed cable system that occurs when operating the elevator. Consequently, the cable forces are kept as low as possible and the cable tension or cable pull ratio required for maintaining the driving ability can be assured.

This task is solved in the invention by a cable tensioning system stated in the preamble of claim **1** by features indicated in its characteristic portion.

Accordingly, the cable tensioning system comprises a rocker configured as a lever supported at the counterweight or the elevator cab, to which the drive cable and the support cable are fastened in such a way spaced from each other, that the spacing ratio a:b of the attachment points of these cables at the rocker referred to the support point or the fulcrum of the rocker at the counterweight or the elevator cab defines the cable pull or force ratio required for the driving ability.

Hereby the driving ability is advantageously no longer directly determined by the weight of an elevator cabin and counterweight, which enables to use lighter elevator cabins. Because the rocker of the cable tensioning system is supported at the counterweight or the elevator cabin, the existing counterweight is used for cable tensioning and for cable length compensation.

If the drive disk of the driving mechanism is located at the top, it is preferred that the rocker be configured as a two-sided lever, wherein the support point of the rocker at the counterweight then lies between the attachment points of drive cable line and support cable line to the rocker, and that both cable falls or lines are directed upwards.

If, on the other hand, the drive disk of the driving mechanism is located at the bottom, it is preferable that the rocker be configured in the shape of a one-sided lever, wherein the support point of the rocker at the counterweight or the elevator cabin is located outside of the attachment points of both cable lines at the rocker and that the drive cable is directed downwards.

The rocker can be configured as a simple lever or as is preferred in circular segment-shaped sections, wherein the support cable line and drive cable line are respectively directed over peripheral circular arcs of the circular segment sections, whose radii correspond respectively to the lever arms a and b of the rocker.

For controlling undesirable rotary movements of the rocker because of operating interruptions or faults or counterweight hunting or bouncing, a damping element is provided between the support point and the rocker, which dampens the undesirable rotary movements of the rocker.

So that the lever ratio of the rocker can be adjusted at the utilization site of the elevator installation, it is preferred that the length of the lever arms a and b of the rocker be adjustable.

The cable tension system in the invention permits location of the driving mechanism at any level next to the shaft or directly below or above same without the necessity of running the entire number of cables through the elevator shaft; this in connection with the closed cable system and the functional separation of the cables according to drive- and support functions.

The novel features which are considered as characteristic for the invention are set forth in particular in the appended claims. The invention itself, however, both as to its construction and its method of operation, together with additional objects and advantages thereof, will be best understood from the following description of specific embodiments when read in connection with the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a diagram of a first embodiment of the cable tensioning system of the invention;

FIG. **1***a* is a diagram of a second embodiment of the cable tensioning system of the invention;

FIG. **2** is a diagram of a third embodiment of the cable tensioning system of the invention;

FIG. **2***a* is a diagram of a fourth embodiment of the cable tensioning system of the invention;

FIG. **2***b* is a diagram of a fifth embodiment of the cable tensioning system of the invention;

FIG. **3** is a diagram of a sixth embodiment of the cable tensioning system of the invention; and

FIG. **3***a* is a diagram of a seventh embodiment of the cable tensioning system of the invention;

FIG. **4** shows an eighth embodiment of the inventive cable tensioning system.

FIG. **4***a* is a diagram of a ninth embodiment of a cable tensioning system of the invention; and

FIG. **4***b* is a diagram of tenth embodiment of the cable tensioning system of the invention.

DETAILED DESCRIPTION OF PREFERRED EMBODIMENTS

In the first version shown in FIG. **1** a support cable **11** fastened to the upper portion of an elevator cabin **12** is

directed over reversing rollers **25** and **26** to a counter or balancing weight **13**, where coming from above it is attached to a rocker **20** of the cable tension system. The driving or power cable **110** is attached to the bottom portion of the elevator cabin **12** and is directed from below to the counterweight **13** over a reversing roller **24**, a drive disk **23** and an additional reversing roller **22**. It is seen that the drive cable **10** is fastened to the rocker **20** at an attachment point **32** and the support cable **11** is fastened to the rocker **20** at an attachment point **31**. The rocker **20** is supported at the counterweight **13** by a bearing or support point **21**.

The support point **21** of the rocker **20** is located externally of the attachment points **32** and **31** of the power cable **10** and the support cable **11**, respectively, so that the rocker **20** acts as a one-sided lever.

The rocker **20** has the shape of two concentric circular segments, wherein the radius of the circular arc of the smaller segment corresponds to the lever arm b of the articulation point **31** at the rocker **20** and the radius of the larger segment corresponds to the lever arm a of the attachment point **32** of the power drive cable **10** at the rocker **20**. In this way the drive cable **10** is conducted over a circular arc with a radius a and the support cable **11** over a circular arc with a radius b in such a way, that the attachment point **32** and **31** respectively of the support cable **11** and the drive cable **10** remain constant as far as their vertical orientation is concerned and thus the drive cable **10** always travels vertically between its reversing roller **22** and its point of engagement at the rocker **20** and the support cable **11** always travels vertically between its reversing roller **26** and its attachment point **31** at the rocker **20**.

The embodiment shown in FIG. **1***a* is similar to that of FIG. **1**, with the exception that the support point is attached to the elevator cabin **12**. In this way, the drive cable **10** always travels vertically between its reversing roller **24** and its point of engagement at the rocker **20**, and the support cable **11** always travels vertically between its reversing roller **25** and its attachment point **31** at the rocker **20**.

The embodiment shown in FIG. **2** is identical to that shown in FIG. **1** with the exception of the rocker **20***a* design. The rocker in FIG. **2** is shaped like a cantilevered beam. However, the support or bearing point **21***a* lies externally of the attachment points **31***a* and **32***a* of the support cable **11** and the drive cable **10**, respectively, just as in the embodiment form in FIG. **1**. The spacings a and b of the attachment points **32***a* of the drive cable **10** and **31** of the support cable **11**, respectively, at the rocker **20***a* define exactly, as is the case in the embodiment in FIG. **1**, the cable pull or tension ratio required at the counterweight for maintaining the driving capacity. The rocker **20***a* transmits a force component defined by the lever ratio a:b from the attachment point **32***a* to the drive cable **10**, which component acts a load dependent cable tension force or pull force for the drive cable **10**.

The embodiments shown in FIGS. **2***a* and **2***b* are similar to those of FIGS. **1** and **1***a*, respectively, but show additionally damping elements **33** and **33***a* of the rockers **20** and **20***a*, respectively.

In the embodiment shown in FIG. **3** the driving or power mechanism is located at the top, unlike the embodiments shown in FIGS. **1** and **2**, this being indicated by the location of the drive disk **23**. In this version the drive cable **10** and the support cable **11** are drawn off the rocker **20***b* towards the top. The rocker **20***b* is configured as a two-sided lever, wherein the bearing or support point **21***b* of the rocker **20***b* is located between the attachment points **32***b* and **31***b* of the drive cable **10** and the support cable **11**, respectively. Proceeding from these attachment points **32***b* and **31***b* the drive cable **10** and the support cable **11** are respectively directed over circular arc-shaped peripheral front faces of the rocker **20**, whose radii correspond respectively to the lever arms a and b of the rocker **20***b*. Thus the rocker **20***b* has the advantage equally so as the rocker **20***b* in the first embodiment shown in FIG. **1**, that the cable articulation point remains oriented in the vertical direction also if angular changes at the rocker occur.

FIG. **3***a* shows an embodiment similar to that of FIG. **3** with the exception that the support point is attached to the elevator cabin **12**.

The embodiment shown in FIG. **4** corresponds, as far as the cable travel and the top position of the driving mechanism as evidenced by the drive disk **23** is concerned, to the embodiment depicted in FIG. **3**. Only the design of the rocker **20***c* differs. It has the shape of scale beam without the previously mentioned circular arc-shaped peripheral sections.

The embodiments shown in FIGS. **4***a* and **4***b* are similar to those of FIGS. **3** and **3***a*, respectively but show additionally a damping element **33***b* and **33***c*, respectively, for rockers **20***b* and **20***c*.

All the embodiment types of the cable tensioning systems in the invention described and shown in FIGS. **1** to **4** have the advantage, that the lever ratio directly defines the cable tension or pull ratio required for the driving capacity and that said ratio is no longer directly affected by the weight of the elevator cab and the counterweight. This enables the use of elevator cabs of lower weight.

In a sensible refinement of the invention it can be provided that the lever ratio a:b in the inventive cable tensioning system is adjustable by an appropriate device, which enables adjustment of the cable tension or pull ratio at the utilization site.

While the invention has been illustrated and described as embodied in a cable tensioning device, it is not intended to be limited to the details shown, since various modifications and structural changes may be made without departing in any way from the spirit of the present invention.

Without further analysis, the foregoing wilt so fully reveal the gist of the present invention that others can, by applying current knowledge, readily adapt it for various applications without omitting features that, from the stancepoint of prior art, fairly constitute essential characteristics of the generic or specific aspects of this invention.

What is claimed as new and desired to be protected by letters patent is set forth in the appended claims.

1. A cable tensioning system for elevators including an elevator cabin, a counterweight, drive and support cables connecting the elevator cabin and the counterweight, and a drive mechanism including a drive disc for driving the drive cable and located above the elevator cabin, said cable tensioning system comprising:

a support point attached to one of said elevator cabin and said counterweight; and

a rocker attached at said support point and having a first attachment point, at which the support cable is attached, and a second attachment point, at which the drive cable is attached, said first and second attachment points being horizontally spaced from

said support point a first distance and a second distance, respectively, a ratio of the second distance to the first distance defining a force ratio required for maintaining driving ability of the drive cable, wherein said rocker is configured as a two-sided lever, said support point being attached between said first and second attachment points, and said drive cable extending upward from said rocker.

2. A cable tensioning system according to claim 1, wherein said first attachment point is located on a first peripheral section of said rocker and said second attachment point is located on a second peripheral section of said rocker said first and second peripheral sections being arc-shaped and having radii corresponding to said first and second distances.

3. A cable tensioning system according to claim 2, wherein said rocker has an element for damping rotational movements of said rocker.

4. A cable tensioning system according to claim 2, wherein the ratio of said first and second distances is adjustable.

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